

claws; forelegs that bear an epiphysis;" (p. 61), and on it goes. These traits are also handy for distinguishing Lepidoptera from caddisflies, or insects from monkeys. Such is the field guide approach; it is adequate when identification is the sole aim.

One of the book's most important features is the detailed distributional and habitat data, but the two maps provided are not of high enough quality to make the most of this information. In addition to these general maps, I would like to have seen a series of high quality, detailed maps included, showing topography, vegetation types, etc.

DeVries adopts what I consider to be intelligent butterfly classifications. For example, *Papilio* is retained as a single genus, and Nymphalidae is recognized in the broad sense. However, there are indications in the book that DeVries' rapport with the systematic community could use improvement. He is troubled by the "strong component of emotionalism or even fanaticism in the "war" among various factions" (p. 32) of systematists, referring here to the evolutionary, phenetic, and cladistic "factions." It sounds sort of frightening, doesn't it? Something akin to the Persian Gulf. I take issue with his statement, being of the opinion that this "jihad" has produced some of the most significant advances in comparative biology since, oh say, the advent of the pencil. But of course I happen to belong to one of these terrorist cells, and am therefore seeing the picture through crazed eyes.—*James S. Miller, Department of Entomology, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024.*

#### LITERATURE CITED

DeVries, P. J. 1985. Hostplant records and natural history notes on Costa Rican butterflies (Papilionidae, Pieridae & Nymphalidae). *J. Res. Lepid.* 24:290–333.

*J. New York Entomol. Soc.* 96(2):248–250, 1988

**The Lives of Butterflies.**—Matthew M. Douglas. 1986. University of Michigan Press, 241 pp. \$45.00.

The study of butterflies has made important contributions to the development of systematics, evolutionary biology, and ecology. Using mainly temperate American examples this book selectively summarizes the biology of butterflies with the aim of providing professional biologists and graduate students a literature base for further research.

After an introduction to contemporary theories about the evolution of insect wings, the formal text begins with a treatment of the phylogenetic origins of the butterflies. Douglas then proceeds to discuss the morphology and physiology of both early stages and adult butterflies, and then covers topics relevant to behavior, population and community ecology, and population genetics. The book concludes with a chapter on coevolution of butterflies and plants, and a postscript encouraging future research. Throughout the text Douglas admirably maintains a strong evolutionary perspective. Two appendices are included that illustrate the geologic time scale and present a list of some butterfly species used in research (both appendices could be deleted without loss to content). The bibliography contains many solid references essential to doing

butterfly research. The illustrations in the first few chapters (but none in the last chapters) and a small section of good color photographs make this book pleasing to the eye. The price, however, is apt to make potential buyers think twice and restrict the book's circulation.

The text is written in an engaging and enthusiastic style that generally gets to the point quickly, covers the subject at a good pace, and contains a minimum of misspellings. Some careful gardening could have condensed the book and eliminated a lot of repetitious phrasing, especially the sections on population biology, migrations, and genetics, which tend to wander around. These criticisms aside, overall Douglas provides us with a good summary for some aspects of butterfly biology and encourages experimental biology as a productive method of furthering research in the field. In this regard the author's own hypotheses and leading questions sprinkled throughout should provide food for thought to some biologists actually doing research on butterflies. The balanced treatment of functional morphology, physiology, organismal, and molecular studies makes this book a useful tool for students of butterflies and to those with a general interest in organismal biology.

For our tastes the book is rather thin on the broad natural history patterns and the ecology of tropical and European butterflies—major sources of information and potential experimental material. Very puzzling is that it is completely unblemished by the notion that systematics is a predictive and necessary tool in butterfly research. We think the author will agree that the majority of researchers take advantage of phylogenetic patterns. Ultraviolet reflectance patterns, osmeteria, sinigrins as feeding stimulants, adult feeding behaviors, genetic polymorphisms, mutualisms with ants, mimicry, and coevolution are not characters that occur randomly or equally among all butterfly groups.

The erratic flight paths and aerodynamically curious wing shapes of butterflies have always attracted considerable attention. Douglas presents, perhaps for the first time in the secondary literature, an introductory discussion of the thoracic musculature, wing shape, and aerodynamics of flight in butterflies. This is an exciting area of research, and as such merits in a book of this character further treatment, even if only greater citation of the primary literature. Perhaps inevitably when dealing with the complicated subject of aerodynamics, a number of erroneous statements are bound to arise. For example, lift on an aerofoil below the stalling point does not decrease but rather increases with increasing angle of attack (p. 51). The notion that butterfly scales enhance aerodynamic performance of the wings (p. 55) is widespread, but is based on the results of only one disputed study (see Martin & Carpenter *In: W. Nachtigall (ed.) 1977, Physiology of Movements, Biomechanics*, Gustav Fischer, Stuttgart). Douglas suggests that even stereotypical "knock-kneed lepidopterists" can catch the fastest butterflies, but as experience in the field will tell, the reason butterflies are in general difficult to catch in free flight relates not to their speed of flight but rather the unpredictable character of the flight path and their extraordinary capacities for maneuverability.

Chapter 8 shows a great enthusiasm for coevolution as a unifying theory in community ecology and evolution and Douglas should be applauded for his efforts. However, some examples used to illustrate coevolution are slightly misleading or simply wrong: Lycaenids and ants are very clearly **not** co-evolved (p. 178)—removing all the lycaenids in the world would have little effect on ants. Butterflies are typically

not plant predators (p. 187)—butterflies typically remove small fractions of their hostplant biomass and do not kill them. It is doubtful that *Heliconius* adults sequester alkaloids from coevolved larval feeding on *Passiflora* (p. 190)—their distasteful properties are derived from the ability to feed on pollen as adults.

The value of over 350 references to diverse and important research papers in the bibliography will not be lost on students of butterflies. However, including other references besides Gilbert and Shapiro from Vane-Wright, R. I. & P. Ackery's, (eds.), 1984, *The Biology of Butterflies*, Symp. Roy. Ent. Soc. 11, and crediting authors of primary research (not just the review author), would further increase the book's utility as a research sourcebook. We feel a citation to certain facts alluded to by Douglas would have been appropriate and led us to the reference (e.g., Flight muscle mechanism and wing articulation, p. 49; 100 hostplants for the painted lady, p. 115; mites reported to weaken butterflies, p. 137; shared flavinoids between Polygonaceae and Rosaceae, p. 179).

In summary, this is a valuable introduction to the field of butterfly biology, and ranks as one of the first contemporary presentations of the wide range of biological investigation on the butterflies. As such, it must not be expected to be the balanced, comprehensive presentation of the field, as was Ford's *Butterflies* in its day. We eagerly anticipate future contributions to the genre which integrate natural history, systematics, and the evolutionary ecology of butterflies from all regions. *The Lives of Butterflies* would be an appropriate companion to such works.—P. J. DeVries and R. Dudley, *Smithsonian Tropical Research Inst., Box 2072, Balboa, Panama*.

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**A Scanning Electron Microscope Atlas of the Honey Bee.**—E. H. Erickson, Jr., S. D. Carlson, and M. B. Garment. 1986. Iowa State University Press, Ames, Iowa. 292 pp. \$51.95.

Poring over an atlas, whether geographical or anatomical, should stimulate the imagination and the sense of adventure. Large pages, multiple illustrations of unknown territories, an abundance of factual detail and varying textures—this is the stuff that feeds the urge to explore. I am pleased to report that this book is a success in these respects. The hundreds of micrographs and photomontages illustrating the surface structures of worker, queen, and drone honey bees, carefully chosen and tastefully arranged on expansive 9 × 12 pages, are at once a dazzling display of present knowledge and an invitation to plunge into the many morphological mysteries that remain unresolved. For although we have more knowledge of the biology—behavior, physiology, morphology—of the honey bee than of any other insect (and indeed almost any other animal species), the figure captions crackle with phrases such as “function unknown,” “maybe,” and “seems to be.” The call to further exploration is clear.

Unfortunately, the high technical and esthetic standards met by the micrographs were not uniformly applied to the rest of this book. The line drawings of the Appendix, although helpful and adequate, are sadly lacking in the beauty and charm of R. E. Snodgrass' classic illustrations in *The Anatomy of the Honey Bee*. The fairly short